CLAIMS

What is claimed is:

1. A heat reservoir device for managing a heat input subject to transient conditions, said heat reservoir device comprising:

a heat transfer subsystem having a thermal path thermally coupled to said heat input;

a heat storage subsystem coupled to said thermal path of said heat transfer subsystem, said heat storage subsystem comprising a phase change material capable of changing phases in response to said transient conditions causing the temperature of said phase change material to rise above its phase change temperature.

2. The heat reservoir device of claim 1, further comprising:

a heat collector thermally coupled to said heat transfer subsystem and said heat input;

a heat rejection subsystem thermally coupled to said heat collector.

3. The heat reservoir device of claim 1, wherein said heat transfer subsystem comprises a component selected from the group consisting of a heat pipe, a thermosyphon, and a liquid-cooling pump.

4. The heat reservoir device of claim 1, wherein said phase change material comprises a material selected from the group consisting of: a hydrated salt, sodium acetate, magnesium nitrate, paraffin, and water.

5. The heat reservoir device of claim 1, wherein said heat storage subsystem further comprises:

a sealed case;

a plurality of fins thermally coupled to said heat transfer subsystem and encapsulated by said sealed case, wherein said phase change material is thermally coupled to said plurality of fins.

6. The heat reservoir device of claim 5, wherein said heat transfer subsystem comprises a heat pipe, and wherein said plurality of fins comprises a series of disc-shaped fins axially distributed along and connected to said heat transfer subsystem.

7. The heat reservoir device of claim 5, wherein said heat transfer subsystem comprises a heat pipe, and wherein said plurality of fins comprises a series of radial fins thermally coupled to said heat transfer system.

8. The heat reservoir device of claim 5, wherein said heat transfer subsystem comprises a heat pipe, and wherein said fins comprise a series of radial pin fins thermally coupled to said heat transfer subsystem.

9. The heat reservoir device of claim 5, wherein said fins are rectilinear, and wherein said sealed case includes a base coupled to said heat transfer subsystem.

10. The heat reservoir device of claim 5, wherein said fins are pin fins, and wherein said sealed case includes a base coupled to said heat transfer subsystem.

11. The heat reservoir device of claim 5, wherein said plurality of fins protrude from a base coupled to said heat transfer subsystem.

12. A heat transfer system for cooling a component subject to thermal transients, said heat transfer system comprising:

a heat collector coupled to said component;

a heat sink coupled to said heat collector;

a heat pipe having a first end and a second end, said first end coupled to said heat collector, and said second end coupled to a heat storage subsystem, wherein said heat storage subsystem comprises: a phase change material capable of changing phases in response to said transient conditions causing the temperature of said phase change material to rise above its phase change temperature;

13. The heat transfer system of claim 12, further comprising:

a sealed case; and

a plurality of fins thermally coupled to said heat pipe and encapsulated by said sealed case, wherein said phase change material is thermally coupled to said plurality of fins.

14. A heat transfer system for managing a heat input subject to transient conditions, said heat transfer system comprising:

a heat storage subsystem comprising a phase change material capable of changing phases in response to said transient conditions causing the temperature of said phase change material to rise above its phase-change temperature;

a heat transfer subsystem thermally coupled to said heat input and said heat storage subsystem;

a heat rejection subsystem coupled to said heat transfer subsystem, said heat rejection subsystem configured to transfer heat to an ambient environment.

15. A method of cooling a component subject transient heat generation, said method comprising the steps of:

determining the steady-state operating temperature of said component;

determining the maximum operating temperature of said component during said transient heat generation;

thermally coupling a heat sink to said component, wherein said heat sink is configured to dissipate heat at said steady state operating temperature;

thermally coupling a heat reservoir device to said component, wherein said heat reservoir device includes a phase change material having a phase change temperature which is less than said maximum operating temperature and greater than said steady state operating temperature.

16. The method of claim 15, wherein said component is contained within a housing, wherein said housing is capable of accommodating a heat-sink of predetermined dimensions, and wherein

a heat sink configured to dissipate heat at said maximum operating temperature would include one or more dimensions exceeding said predetermined dimensions.

17. The method of claim 15, wherein said component is contained within a housing, wherein said component within said housing experiences a predetermined airflow, and wherein a heat sink configured to dissipate heat at said maximum operating temperature would require an airflow higher than said predetermined airflow.

18. The method of claim 15, wherein said component is contained within a housing, wherein said housing experiences predetermined ambient temperature, and wherein a heat sink configured to dissipate heat at said maximum operating temperature would require an ambient temperature lower than said predetermined ambient temperature.